In Lower Florida wilds

A volume by SIMPSON,[2] described as a naturalist's observations on the geology, geography, and life of the more tropical part of the state, presents much scientific information in an attractive popular manner, well illustrated with plates from good photographs. Two chapters should be of particular interest to plant ecologists, since the one outlines the plant succession from the pine lands to the "hammocks," while the other gives a picture of the primeval forest of semitropical type. The author's opinion that the broad level evergreen forest of the "hammock" is the true climax vegetation seems well founded, while his emphasis upon the destructive and retrogressive effect of fire appears to furnish a part, at least, of the explanation why such vegetation has not dominated a larger portion of the peninsula.

The tale of the evolution of the land is attractively told, and seems as scientifically accurate as the story of the succession in the forests.—GEO. D. FULLER.

NOTES FOR STUDENTS

Organic acids and anthocyanin formation.—COMBES,[3] ROSE,[4] NICOLAS,[5] and other workers have found that anthocyanin formation is accompanied by increased oxygen fixation. MIRANDE,[6] KEEBLE[7] and ARMSTRONG, and MIEGE[8] have found that anthocyanin formation occurs regularly in tissues containing comparatively large quantities of oxidases. Later work, such as that of COMBES,[9] WILLSTÄTTER,[10] and EVEREST,[11] has shown that anthocyanins

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[2] SIMPSON, C. T., In Lower Florida wilds. 8vo. pp. xv+404. *pls. 64. maps. 2.* New York: Putnam's Sons. 1920. $3.50.

[3] COMBES, R., Les echanges gazeux des feuilles pendant la formation et la destruction des pigments anthocyaniques. Rev. Gen. Botanique **27**:177–212. 1910.

[4] ROSE, E., Étude des echanges gazeux et de la variation des sucres et des glucosides au cours de la formation des pigments anthocyaniques dans les fleurs de *Cobaea scandens*. Rev. Gen. Botanique **26**:257–270. 1914.

[5] NICOLAS, G., Contribution a l'étude des relations qui existent, dans les feuilles, entre la respiration et la presenxe de l'anthocyane. Rev. Gen. Botanique **31**:161–178. 1919.

[6] MIRANDE, M., Sur l'origine de l'anthocyanine, deduite de l'observation de quelques insectes parasites des feuilles. Compt. Rend. Acad. Sci. **145**:1300. 1907.

[7] KEEBLE, F., and ARMSTRONG, E. F., The rôle of oxidases in the formation of anthocyan pigments of plants. Jour. Genetics **2**:277–311. 1912.

[8] MIEGE, E., Recherches sur les principales espéces de *Fagopyrum*. Thesis for Doctorate. Paris. 1914.

[9] COMBES, R., Production experimentale d'une anthocyane identique a celle qui se forme dans les feuilles rouges en automne, en partant d'un compose extrait des feuilles vertes. Compt. Rend. Acad. Sci. **147**:1002–1004. 1913.

[10] WILLSTÄTTER, R., Über die Farbstoff der Bluten und Fruchte. Sitz. Ber. Akad. Wiss. 402–411. 1914.

[11] EVEREST, E., The production of anthocyanins and anthocyanidins. Proc. Roy. Soc. B. **87**:444–453. 1914.

can be produced from flavones by reduction. In the light of this work, Miss KOHLER[12] was led to believe, as NICOLAS and others previously had been, that anthocyanin formation should be correlated with organic acid accumulation, her contention being that organic substances such as carbohydrates were oxidized to organic acids, thereby reducing certain flavones and causing anthocyanin formation.

The evidence for the accumulation of organic acids during formation of red plant pigment has been more or less contradictory. WIESNER[13] and KRAUS[14] have found that acidity of the cell sap increases during autumnal reddening of leaves. ASTRUC[15] has shown that acidity descreases in petals of flowers during the reddening process. The tissues immediately beneath the red epidermis of apples were found to be less acid than tissues beneath a green epidermis in the same fruit, as determined by RIVIERE and BAILHACHE.[16] BERTHELOT and ANDRE[17] state that the amount of free acid in the plant as determined by titration of expressed juice bears no relation to the total amount of organic acid in the plant, as for the most part the acids are combined as salts of plant bases. Miss KOHLER also objects to titration of expressed juice because of the tendency of the alkali used to combine with phenolic compounds such as tannins and anthocyanins. After several unsatisfactory attempts to precipitate the phenolic compounds by the use of hide powder, zinc acetate, and analgesine (antipyrine), Miss KOHLER found that free organic acids could be quantitatively dialyzed out of the expressed juice and therefore used this method in her work. The acids were then titrated with a base and calculated as free organic acid. Combined organic acids were determined, using oven dried samples of tissue, by heating at dull red heat in a muffle. A known quantity of N/10 sulphuric acid was then added to the ash to neutralize the bases liberated by the combustion, and the acid residue titrated with alkali to find how much acid was neutralized by the ash. The figure obtained in this way was added to that of the free organic acid and the sum placed under the caption "total organic acids." Total organic acids determined in this way were found to increase in corollas of *Cobaea scandens* during the process of development from bud to mature flower, along with anthocyanin development,

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[12] KOHLER, DENISE, Étude de la variation des acides organiques an cours de la pigmentations anthocyanique. Memoir to Faculty of Science, Univ. Paris. 1921.

[13] WIESNER, J., Untersuchungen über die Herbstliche Entlaugung der Holzgewachse. Sitz. Ber. Akad. Wiss. **64**:465–510. 1871.

[14] KRAUS, C., Studien über die Herbstfarbung der Blätter und über Bildungweise der Pflanzensauren. Buchner's Repert. Pharm. **22**:273. 1873.

[15] ASTRUC, A., Recherches sur l'acidity végétale. Ann. Sci. Nat. Bot. **17**:65–109. 1903.

[16] RIVIERE, G., and BAILHACHE, G., De l'influence de la lumiere directe sur la composition chimique des fruits. Jour. Soc. Nat. Hort. France, IV. **9**:627. 1908.

[17] BERTHELOT, M., and ANDRE, G., Remarques sur la formation des acides chez les vegetaux. Compt. Rend. Acad. Sci. **32**:502. 1901.

when the flowers were allowed to remain attached to the plant. When detached there was no increase during the opening of the corolla. Leaves of *Ampelopsis tricuspidata* gathered September 17, October 1, and again on November 2, showed a progressive increase in total organic acids during the autumnal reddening. When allowed to redden detached from the plant, there was no accumulation of acids. Small plants of buckwheat, when germinated in the dark, showed a steady increase in total acids until the eighteenth day after germination. When exposed to light during this time, a red pigment developed in the hypocotyl axis, but no corresponding increase in total acids was found, either in plants attached to or detached from the parent stock. Miss KOHLER states that this fact may mean that the destruction of organic acids formed in this case is greater than their production.

It is to be regretted that Miss KOHLER has not included some similar determinations upon leaves which remain green under certain conditions and which redden under certain other conditions, in order that a comparison might be made. There is some doubt in the reviewer's mind that titration of ash, after incineration of plant tissue, gives an approximate value of the combined organic acids in the tissue before incineration. Plant tissue is a complex material. Salt combinations other than those of organic acids with inorganic bases may be altered greatly by incineration, and may leave a basic ash. Organic acids may as well be combined with organic bases within the plant and both would be lost on heating. There is even the possibility of a mixture of inorganic salts becoming more basic upon heating in a muffle. There is a tendency toward accumulation of mineral salts as the leaf ages during autumn, according to PALLADIN.[18] This accumulation might account for an increase in basicity of ash independent of color formation. In the same way migration of mineral salts into corollas and subsequent use of certain anions such as sulphates, nitrates, and phosphates in building complex compounds connected with reproduction may leave basic elements which combine in various ways and which would increase basicity of ash upon incineration. On account of the many criticisms which might be justly directed against this method of determination of combined organic acid, and on account of the insufficiency of our knowledge of complex plant compounds, it is hoped that the author of the paper will continue her studies, including some corollas which do not redden at the time of opening, and some leaves which do not redden in autumn, together with other methods for quantitatively determining the acids in question.—J. M. ARTHUR.

Vegetation of Lower California.—As the result of an expedition conducted by members of the United States Bureau of Biological Survey in 1905 and 1906,

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[18] PALLADIN, V. I., Plant physiology. p. 83. 6th. ed. transl. by LIVINGSTON, B. E., 1917.